

## REMARKS

### Status of Claims

Claims 1, 11-21, 27-36, 38-40, 42, 43, 45, and 46 are pending. Claims 1, 11-15, 17-21, 27-36, 38-40, 42, 43, 45, and 46 have been rejected under 35 U.S.C. §102. Claim 16 has been rejected under 35 U.S.C. §103. Claims 1, 11-13, 15, 21, and 43 have been amended. Support for the amendments to these claims is found in the Specification from the first full paragraph on page 12 to the first full paragraph on page 14. As noted above Claims 12, 13 and 15 have been amended, the amendments correct minor editorial errors. Claims 2-10, 22-26, 37, 41, and 44 have been cancelled in previous correspondence. Claims 1, 11-21, 27-36, 38-40, 42, 43, 45, and 46 remain for consideration upon entry of the present Amendment. No new matter has been added.

### Objections to Information Disclosure Statement

In the Final Office Action, the Examiner states that an Information Disclosure Statements (IDS) filed 06/01/2007 allegedly fails to comply with the provisions of 37 CFR 1.97, 1.98 and MPEP §609. Specifically, the Examiner notes that dates of publication for two references were not provided on Form PTO-1449, that a legible copy of foreign patent document GB 2 210 619 was not provided, and that a concise explanation of foreign patent document DE 4306119 (a non-English language document) was not provided. In view thereof, Applicant submits the following along with a Supplemental Information Disclosure Statement appended hereto and made a part of this paper.

Firstly, as is shown in a marked-up version of the originally submitted Form PTO-1449, with the Examiner's initials present (appended hereto and made a part hereof), dates (e.g., a month and year of publication) were provided for the references noted by the Examiner. For example, an article entitled "Noise and Vibration Control Engineering Principles and Applications" by Beranek et al. shows a publication date of "Aug. 1992" on the form PTO-1449, and similarly, an article entitled "SONAR Gets into the Flow" by Gysling et al. shows a publication date of "January 2004".

Secondly, the Supplemental IDS now includes a legible copy of patent document GB 2 210 619 and, in English, the title, abstract, and drawings of the German reference DE 4306119 as well as a concise explanation of the relevance of the reference, in accordance with 37 CFR 1.98(a)(3).

In view of the foregoing, Applicants request that the Examiner consider the articles originally submitted in the IDS of 01 June 2007, consider the copy of British reference GB 2 210 619 now presented and consider German reference DE 4306119, and further entered these references in the record of the present application.

Claim Rejections -- 35 U.S.C. §102

Claims 1, 11-15, 17-21, 27-36, 38-40, 42, 43, 45, and 46 have been rejected under 35 U.S.C. §102(b) as allegedly being anticipated by an IEEE article entitled "Sensing Turbulence Transit Time by Pulsed Ultrasound for Single-Phase Fluid Flow Measurement," by Harshal B. Nemade et al. (hereinafter "Nemade").

Firstly, without addressing the patentability of independent Claims 1, 11, 21 and 43 as previously presented in view of Nemade, and merely to streamline prosecution of the present application, clarifying amendment have been made to the independent claims to even further recite the subject matter for which Applicants regard as its invention. Support for the clarifying amendment may be found in the original disclosure and, for example, at least at the first full paragraph of page 12 to the first full paragraph at page 14 of the Specification as filed. Thus, no new matter is added.

Nemade merely discloses the measurement of fluid flow characteristics (turbulence) by the detection of tagging markers at two locations with regard to a pipe through which the fluid flow is directed. Sensors are used at the two locations to detect the tagging markers. The transit time of the tagging marker between the two locations is estimated using a cross-correlation function of  $x(t)$  and  $y(t)$  signals from the sensors. A simple arithmetic calculation is made to calculate the velocity of the flow from the sensor spacing and the transit time.

Accordingly, Nemade fails to disclose, teach, or suggest processing sensor signals by a spatial-temporal transformation to define a convective ridge from an  $x$ - $t$  domain to a  $k$ - $\omega$  domain, the convective ridge representing a concentration of disturbances that convect with fluid flow, and determining the slope of at least a portion of the convective ridge to determine the flow velocity of the fluid, as now recited in Claim 1. On the contrary, Nemade utilizes cross-correlation which simply involves measuring the time it takes for ultrasonic beams to transit across a flow path at two axially displaced locations along the path of the flow and correlating variations in these times with properties of the flow. The present invention as now recited in Claim 1, on the other hand, uses the spatial-temporal frequency content of time stationary sound fields and displays them using three-dimensional power spectra in which power is decomposed in accordance with specific spatial wave numbers and temporal frequencies (known as  $k$ - $\omega$  plots). On these  $k$ - $\omega$  plots, power is distributed in regions known as "convective ridges," the slopes of which indicate convective velocity. Using cross-correlation as in Nemade does not involve the use of spatial-temporal transformations to define the convective ridge from the  $x$ - $t$  domain to the  $k$ - $\omega$  domain (known as  $k$ - $\omega$  processing) as recited in claim 1. Instead, Nemade uses the simple arithmetic calculation to determine flow velocity, and there is no display of three-dimensional power spectra in accordance with wave numbers and frequencies as there are in the generation of the  $k$ - $\omega$  plots. Accordingly, processing signals by spatial-temporal transformations to define a convective ridge from an  $x$ - $t$  domain to a  $k$ - $\omega$  domain, the convective ridge representing a concentration of disturbances that convect with fluid flow, as recited in claim 1, is patentably distinct from the use of cross-correlation, as disclosed in Nemade.

Because Nemade fails to disclose, teach, or suggest processing sensor signals by a spatial-temporal transformation to define a convective ridge from an  $x$ - $t$  domain to a  $k$ - $\omega$  domain, the convective ridge representing a concentration of disturbances that convect with fluid flow, and determining the slope of at least a portion of the convective ridge to determine the flow velocity of the fluid as now recited in independent Claim 1, Claim 1 is not anticipated by Nemade. For at least this reason, Claim 1 as now written is deemed allowable. In view thereof, Applicants respectfully request that the Examiner reconsider and withdraw the rejection of Claim 1.

Nemade also fails to disclose, teach, or suggest a processor that performs a spatial-temporal transformation to define a convective ridge from the  $x$ - $t$  domain to the  $k$ - $\omega$  domain in response to sensor signals, and which determines a slope of at least a portion of the convective ridge representing a concentration of disturbances that convect with the flow to determine flow velocity of the fluid, as now recited in independent Claim 11, for at the same reasons presented above with regard to Claim 1. In view thereof, Claim 11 as now written is not anticipated by Nemade and is deemed allowable. Accordingly, Applicants respectfully request that the Examiner reconsider and withdraw the rejection of Claim 11, as now written.

Dependent claims, by definition, further define the subject matter of the independent claims from which they depend. Because Claims 12-15, 17-20, 27-36, 38-40, 42, and 45 depend from independent Claim 11, Claims 12-15, 17-20, 27-36, 38-40, 42, and 45 add recitations that further define the subject matter of independent Claim 11. Because Claim 11 as now written is believed to be allowable for at least the reasons presented above, Claims 12-15, 17-20, 27-36, 38-40, 42, and 45 are therefore also believed to be allowable. Consequently, Applicants respectfully request that the rejections of Claims 12-15, 17-20, 27-36, 38-40, 42, and 45 be reconsidered and withdrawn.

Nemade further fails to disclose, teach, or suggest means for processing sensor signals by a spatial-temporal transformation to define a convective ridge from the  $x$ - $t$  domain to the  $k$ - $\omega$  domain, the convective ridge representing a concentration of disturbances that convect with flow, and means for determining the slope of at least a portion of the convective ridge to determine the flow velocity of the fluid, as now recited in Claim 21, for at least the same reasons presented above with regard to Claim 1.

Because Nemade also fails to disclose, teach, or suggest the above described means for processing and means for determining as recited in independent Claim 21, Claim 21 is not anticipated by Nemade. For at least this reason, Claim 21 as now written is deemed allowable, and Applicants respectfully request that the Examiner reconsider and withdraw the rejection of Claim 21.

Nemade still further fails to disclose, teach, or suggest a processor, in response to sensor signals, performing a spatial-temporal transformation to define a convective ridge from an x-t domain to a k- $\omega$  domain, the convective ridge representing a concentration of disturbances that convect with the flow to determine the flow velocity of fluid, wherein the processor uses an array processing algorithm to determine the flow velocity of the fluid, as now recited in Claim 43, for at least the same reasons presented above with regard to Claim 1.

Accordingly, independent Claim 43 as now written is not anticipated by Nemade. For at least this reason, Claim 43 is deemed allowable, and Applicants respectfully request that the Examiner reconsider and withdraw the rejection of Claim 43.

Dependent claims, by definition, further define the subject matter of the independent claims from which they depend. Because Claim 46 depends from independent Claim 43, Claim 46 adds recitations that further define the subject matter of Claim 43. Because Claim 43 as now written is believed to be allowable for at least the reasons presented above, Claim 46 is therefore also believed to be allowable. Consequently, Applicants respectfully request that the rejection of Claim 46 be reconsidered and withdrawn.

#### Claim Rejections – 35 U.S.C. §103(a)

Claim 16 has been rejected under 35 U.S.C. §103(a) as being unpatentable over Nemade in view of U.S. Patent No. 6,609,069 to Gysling (hereinafter “Gysling”). The Examiner alleges that Nemade discloses a method and apparatus as discussed in the Office Action. The Examiner also notes that Nemade does not disclose the Capon algorithm. The Examiner further alleges that Gysling discloses using the Capon algorithm to have accurate estimate results and that it also would have been obvious to one of ordinary skill in the art at the time of the invention to modify Nemade to have the Capon algorithm as taught by Gysling in order to have accurate estimate results.

However, Gysling is not seen to cure the above described deficiencies in the application of Nemade to independent Claim 11, from which claim 16 depends. In view thereof, it is respectfully submitted that Claim 11 is allowable over the proposed combination of Nemade and Gysling. Further, it is respectfully submitted that claims that

depend from a claim that is non-obvious are themselves necessarily non-obvious. Because Claim 16 depends from Claim 11, and because Claim 11 as now written is asserted to be novel and non-obvious for the reasons presented above, Claim 16 is necessarily non-obvious. Applicants, therefore, respectfully submit that Claim 16 is allowable. Accordingly, Applicants respectfully request that the rejection of Claim 16 be reconsidered and withdrawn.

#### Conclusion

Applicants believe that the foregoing amendments and remarks are fully responsive to the Office Action and that the claims herein are allowable. An early action to that effect is earnestly solicited.

If the Examiner believes that a telephone conference with Applicants' attorneys would be advantageous to the disposition of this case, the Examiner is invited to telephone the undersigned.

Applicants believe that no fees are due with the submission of this Amendment and the submittal of the Supplemental IDS appended hereto. If, however, any fees are in fact due with respect to this Amendment and Supplemental IDS, the Commissioner is hereby authorized to charge such fees to Deposit Account No. 50-0260, Order No. CC-0700, maintained by the undersigned attorney.

Respectfully submitted,

ALAN D. KERSEY

By 

Michael Grillo,  
Attorney for Applicant  
Registration No. 34,612

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CiDRA Corporation  
50 Barnes Park North  
Wallingford, CT 06492  
Telephone: (203) 626-3341